PRELIMINARY SOILS INVESTIGATION

PHASE I - KAOPA SUBDIVISION UNIT 3

KAILUA, OAHU, HAWAII

for

HAWAIIAN PACIFIC INDUSTRIES

W.O. 118

August 25, 1971

ERNEST K. HIRATA & ASSOCIATES

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Soils and Foundation Engineering
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August 25, 1971
W.O. 118-A

Hawaiian Pacific Industries
1020-E Keolu Drive
Kailua, Oahu, Hawaii 96734

Attention: Mr. J.A. Hogan

Subject: Preliminary Soils Investigation
Phase I - Kaopa Subdivision Unit 3
Kailua, Oahu, Hawaii

Gentlemen:

The following report presents the results of a soils investigation conducted on the subject property. A preliminary site plan showing the area covered by this investigation is enclosed in the Appendix. This investigation was authorized to determine the subsurface soil conditions at the site and to provide preliminary recommendations for the proposed development.

SITE DESCRIPTION

The subject area is located along the western portion of Enchanted Lakes adjacent to the proposed extension of Keolu Drive. The area designated as Phase I is bounded on the north by the Kaopa #2 Subdivision presently being graded. The eastern boundary is delineated by the proposed extension of

Keolu Drive while the southern boundary is limited by the Kaopa #1 Subdivision. The western boundary of Phase I lies parallel with a proposed 56 feet wide road found at the base of several gradually rising ridges.

The major portion of Phase I lies in the flat lowland area which was once the site of a swamp. At present, a temporary drainage ditch has been excavated along side the proposed Keolu Drive extending into Kaopa #2 Subdivision. A pump is located adjacent to test pit #1 where the water from the drainage ditch is pumped into the Enchanted Lakes.

The flat lowland area is covered with a thick growth of brush and reeds, and ponded water was observed.

PROPOSED GRADING

Grading plans for the site have not been completed, however present plans anticipate removal of the soft material to firm coral or bedrock material. The excavated material is to be replaced with a rock fill upon which compacted certified fill is to be placed until final grades for residential homes have been developed.

FIELD EXPLORATION

Field exploration was performed on August 10, 1971 with the use of a backhoe for six exploratory test pits.

Exploratory test pits were excavated using a 24 inch wide bucket. Test pits ranged in depth from 4 to 10 feet. The approximate locations of the test pits are shown on the site plan enclosed in the Appendix.

The soils were logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System. The Log of Exploratory Test Pits can be found on Plates A1 and A2 in the Appendix.

Undisturbed and bag samples were recovered from the exploratory test pits for laboratory testing. Undisturbed samples were obtained by driving a brass tube into the walls of the excavations.

LABORATORY TESTS

Laboratory testing was performed on the undisturbed and bag samples taken from the test pits. Laboratory tests included

atterburg limits, moisture density relationships, consolidation, compaction, swells and remolded swells. Test results and testing procedures are described in the attached Appendix.

CONCLUSIONS AND RECOMMENDATIONS

Field exploration indicates that the lowland area consists of soft compressible organic clays underlain by finger coral. The clays may range in thickness from two to five feet.

The surface soils at the base of the gradually rising ridges consist of silty clays, and sandy silts. Underlying the surface soils are clayey silts and organic clays. The exploratory test pits indicate a variability of thickness of the black organic clays. Test pit 4 encountered none of the soft organic material but instead encountered a hard black basalt at a depth of 5 feet.

A consolidation test run on an undisturbed sample of the black clay indicated that the soil is highly compressible. We recommend removal of the black organic clays. The exact extent of the removal will be determined in the field, as

variations in thickness were encountered in all test pits.

The site is feasible for the proposed development provided all soft clays are excavated and removed down to firm weathered bedrock or finger coral. Once the soft material is removed, rock fill can be placed on the finger coral or weathered bedrock. Excavation of the material should be conducted with caution in areas adjacent to Kaopa #1 to prevent the soft clays from moving laterally causing settlement in the already finished graded lots.

The excavated soft clays may be placed in the school site near Kaopa #2 in the playground areas provided the material is dried and properly compacted.

Foundation recommendations for Phase I will be determined by the soil properties of the imported fill. Evaluation of the bearing capacity and swell potential will be determined upon completion of mucking and grading operations.

We appreciate this opportunity to be of service. Should you have any questions, please call on us.

Respectfully submitted,

Ernest K. Hirata & Associates

Ernest K. Hirata

Ernest K. Hirata P.E. 2732

ERNEST K. HIRATA
REGISTERED PROFESSIONAL ENGINEER
No. 2732
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APPENDIX OF LABORATORY TESTING

Classification

The field classification is verified in the laboratory, also in accordance with the Unified Soil Classification System. Laboratory classification is determined by both visual examination and Atterburg Limit Tests. The final classification is shown on the "Boring Logs".

Moisture-Density

The field moisture content and dry unit weight are determined for each of the undisturbed soil samples. The information is useful in providing a gross picture of the soil consistency between borings and any local variations. The dry unit weight is determined in pounds per cubic foot and shown on the "Boring Logs". The field moisture content is determined as a percentage of the dry unit weight.

Consolidation

Settlement predictions of the soil's behavior under load are made on the basis of the consolidation tests. Loads are applied in several increments in a geometric progression,

and the resulting deformations are recorded at selected time intervals. Porous stones are placed in contact with the top and bottom of each specimen to permit addition and release of pore fluid. Results of undisturbed samples are plotted on the "Consolidation-Pressure Curve".

Compaction Test

Compaction tests were performed on bag samples to determine the density and moisture relationships. The tests were performed according to the modified AASHO T 180-57.

Swell Tests

Swell tests were performed to determine the expansiveness of the onsite surface soils. The tests were performed on both the undisturbed ring samples and remolded samples under different surcharge loads.

The remolded samples were compacted to 90% and 85% of the maximum density at 100% of optimum moisture content and inundated for a period of 24 hours. Total swell is indicated as a percentage of the original height.

LOG OF EXPLORATORY TEST PITS

TP 1	Elev. 2 ±	0 to 2.5 feet	Silty CLAY (OH - Pt) - Black, very soft. Water at 1.0 feet.
		2.5 to 4 feet	White Finger CORAL
TP 2	Elev. 4 ±	0 to 10 feet	FILL - Silty Clay (CL) - Mottled reddish brown, stiff.
TP 3	Elev. 5 ±	0 to 4 feet	FILL - Silty Clay (CL) - Mottled orange brown, stiff.
		4 to 9 feet	Organic CLAY (OH) - Black, moist, soft, odor. Seepage at 5 feet.
		9 to 10 feet	Weathered Rock - Clayey Silt, mottled orange, hard.
TP 4	Elev. 4 ±	0 to 2 feet	Silty CLAY (CL) - Mottled reddish yellow, soft to medium stiff, moist.
		2 to 5 feet	Clayey SILT (MH) - Mottled red and yellow, medium stiff to stiff.
		5 to 5.5 feet	Black Basalt - hard.
TP 5	Elev. 3 ±	0 to 4 feet	Sandy SILT (ML) - Light brown, rocky, dry, hard.
		4 to 7 feet	Organic CLAY (OH) - Black, soft to medium stiff, organic matter.
		7 to 7.5 feet	Weathered Rock - clayey silt, yellowish brown, hard. Seepage at 7.5 feet.

TP 6	Elev. 4 ±	0 to 4.5 feet	Sandy SILT (ML) - Light brown, dry, hard.
		4.5 to 7 feet	Organic CLAY (OH) - Black, moist, soft to medium stiff. Seepage at 6.5 feet.
		7 to 8 feet	Weathered Rock - clayey silt, mottled brown, hard.

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JOB Kaopa #3 - Phase I BORING NO. TP 5

DEPTH 6.5'

CONSOLIDATION-PRESSURE CURVE

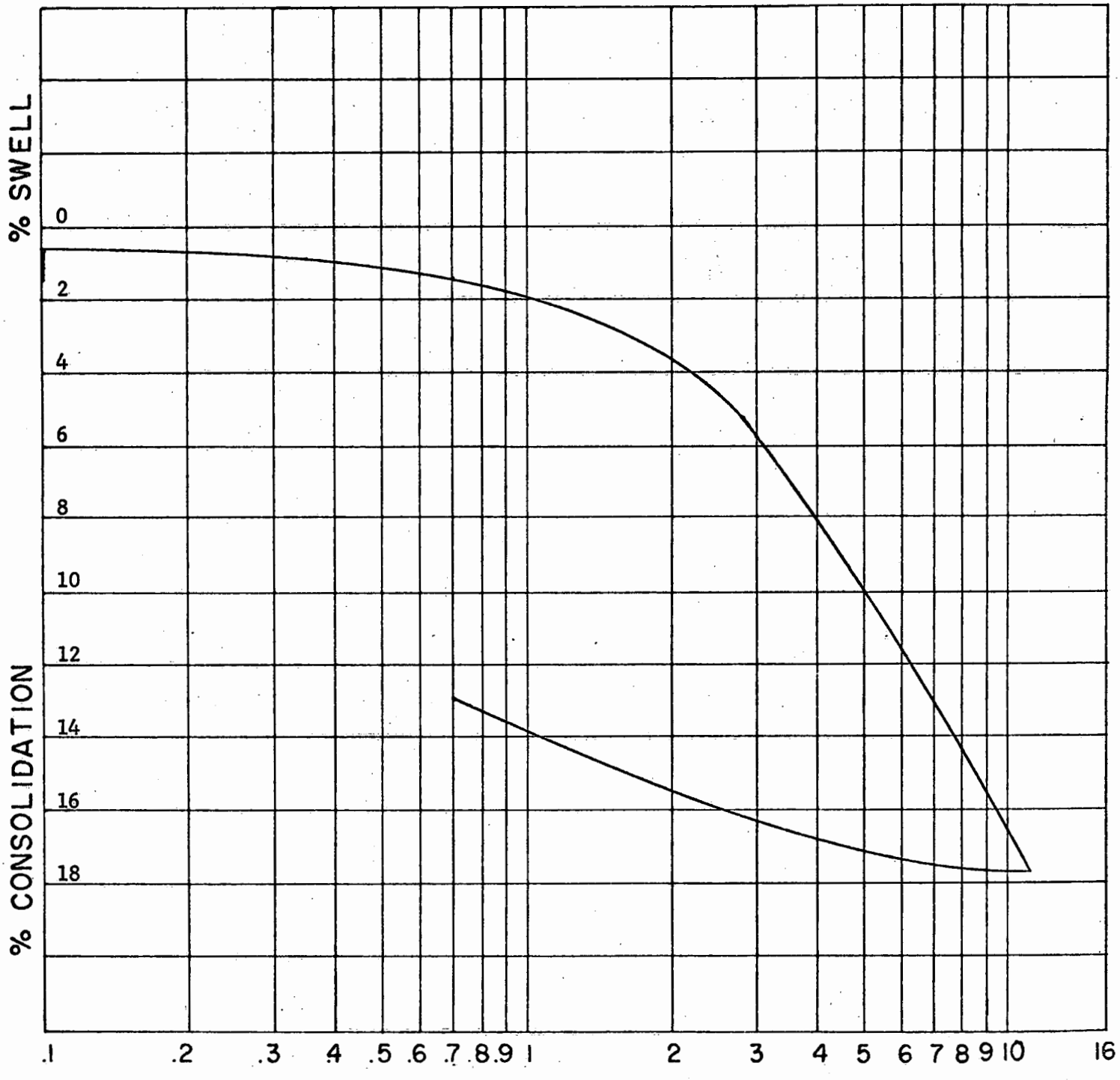

Plate B1

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JOB Kaopa #3 - Phase I

BORING NO. TP 4

DEPTH 5'

CONSOLIDATION-PRESSURE CURVE

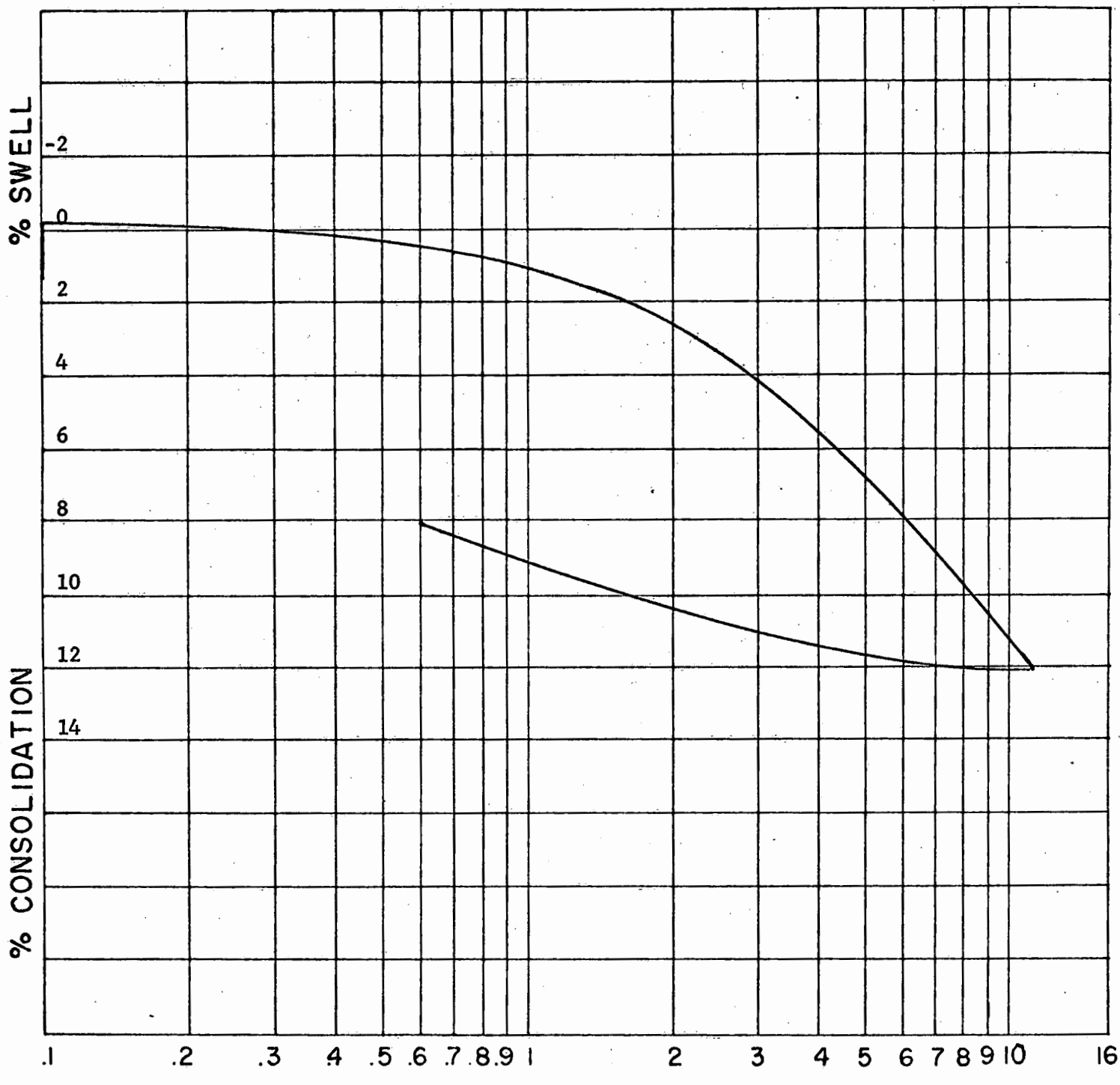

Plate B2

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JOB Kaopa #3 - Phase I BORING NO. TP 5

DEPTH 0' - 3'

CONSOLIDATION-PRESSURE CURVE

REMOLDED

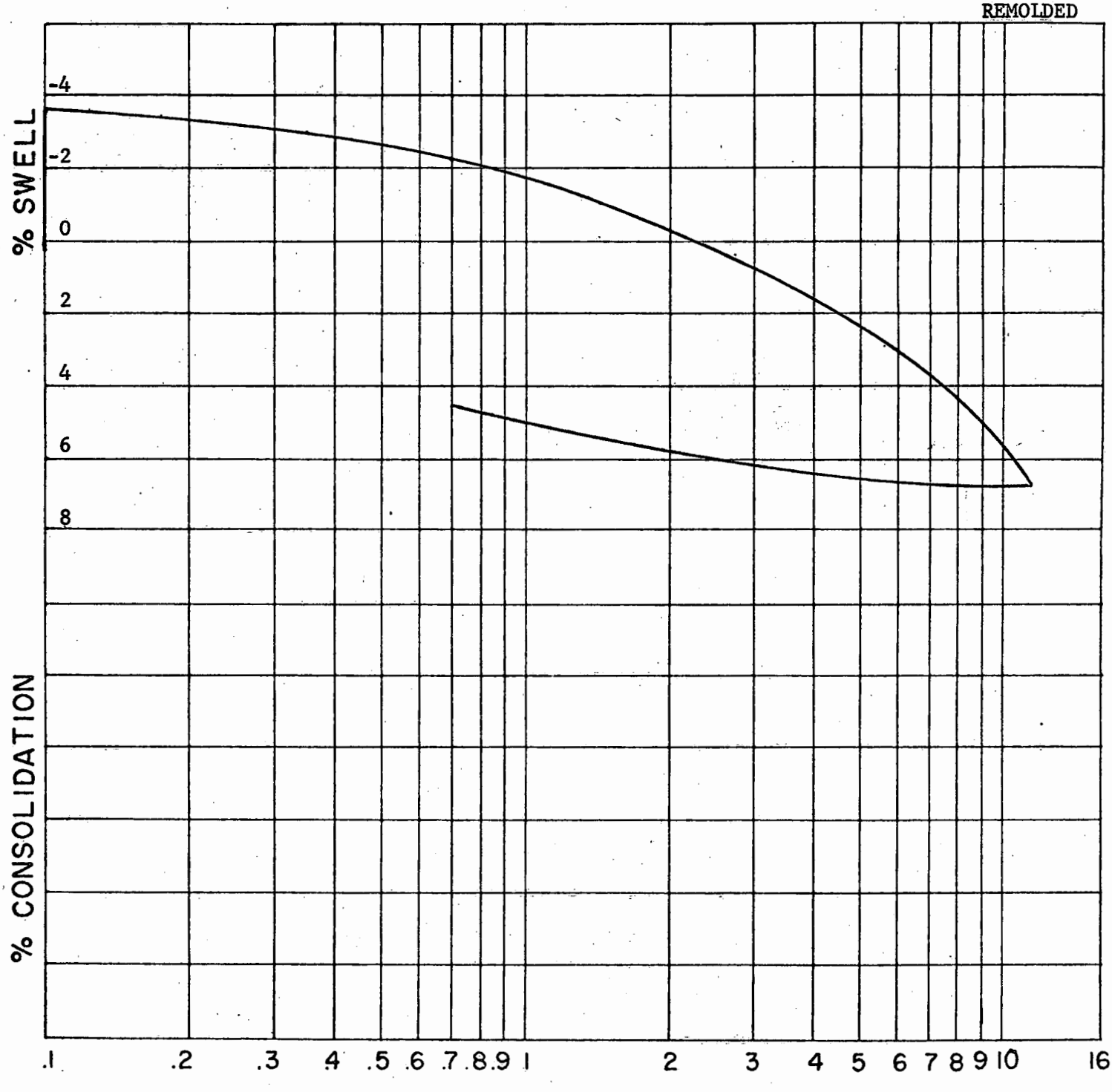
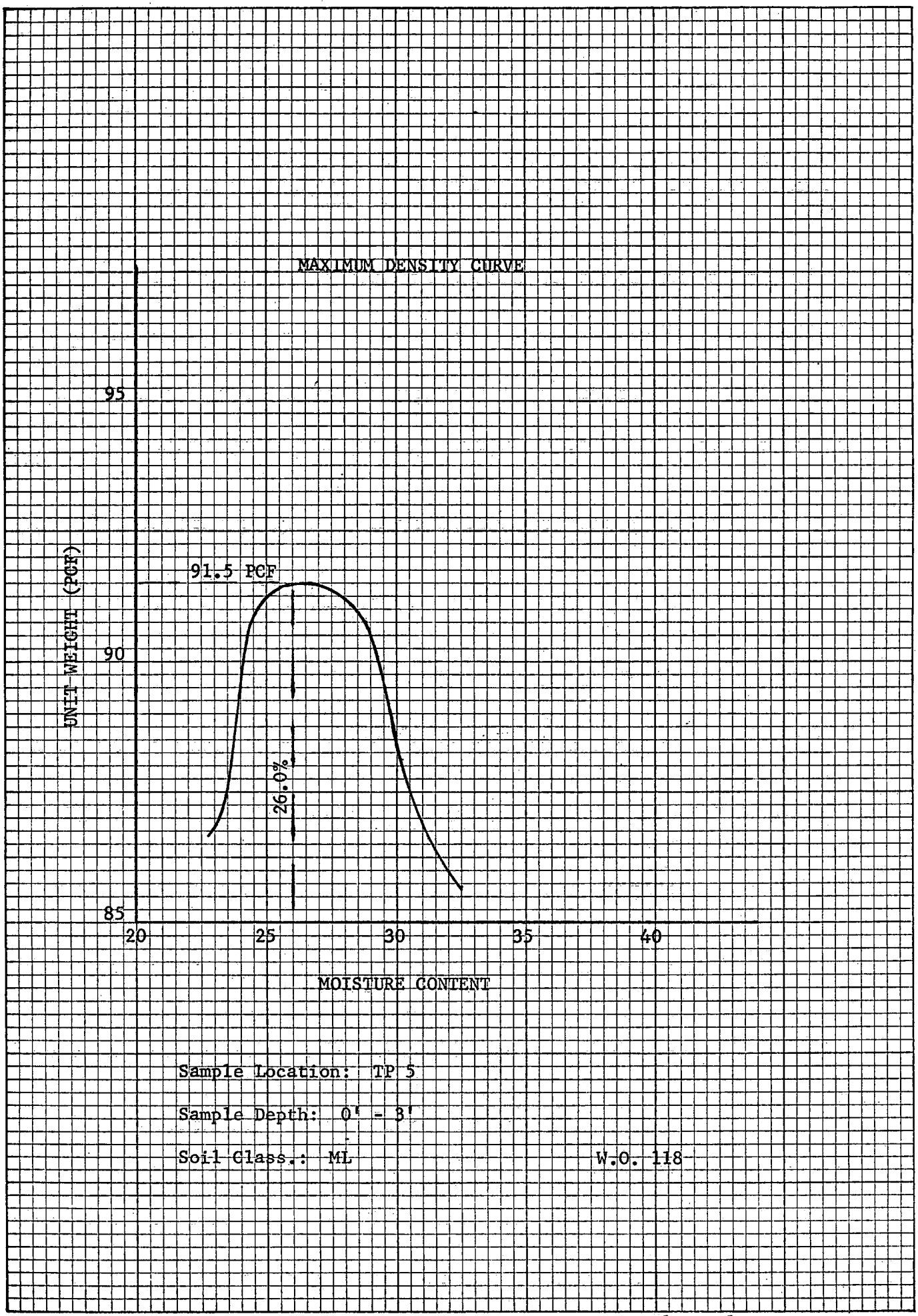


Plate B3



Sample Location: TP 5

Sample Depth: 0' - 3'

Soil Class.: ML

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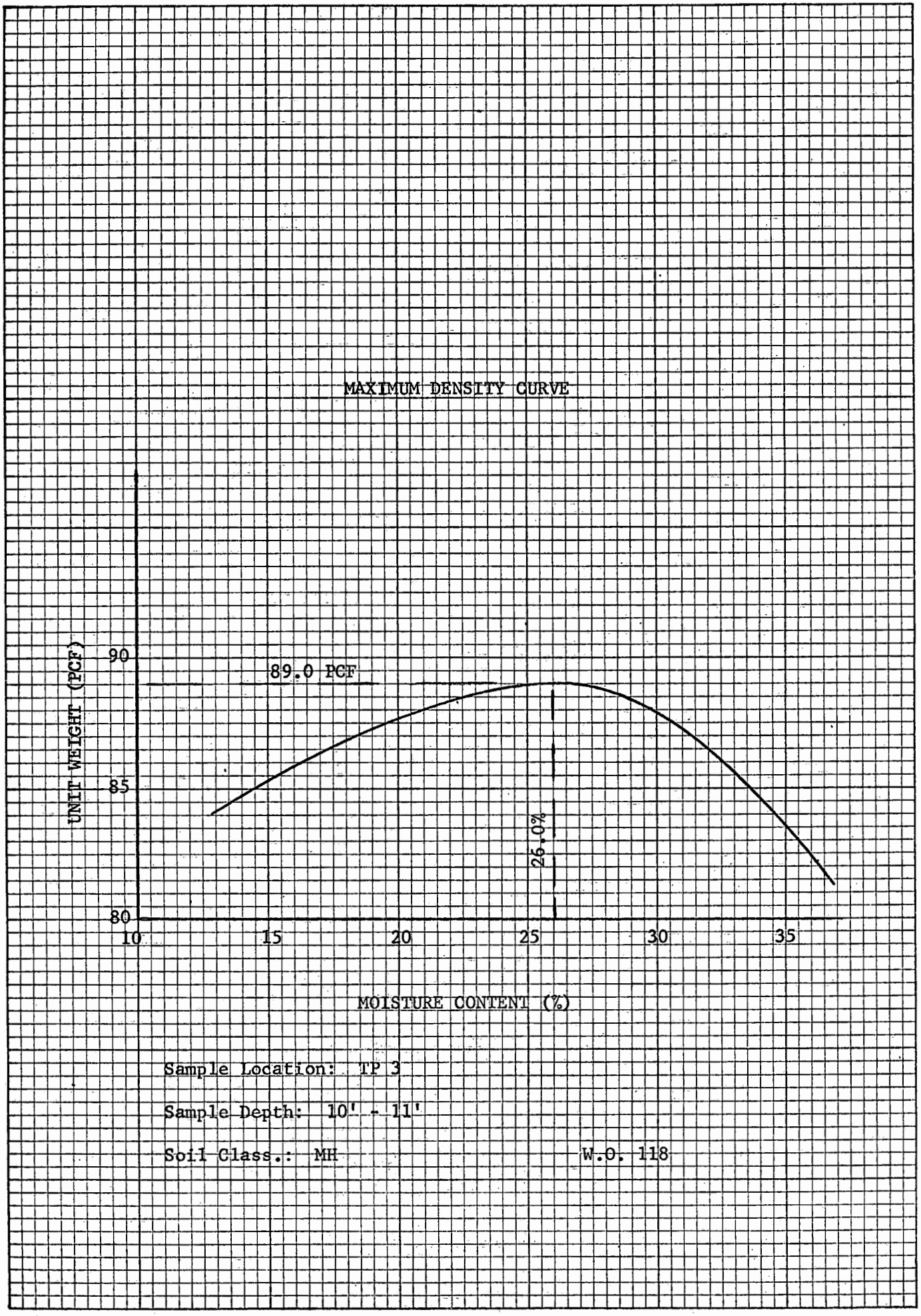
Plate C1



Sample Location: TP 3

Sample Depth: 10' - 11'

Soil Class.: MH W.O. 118

Plate C2

LABORATORY TEST RESULTS

Project: KAOPA #3 - Phase I W.O. 118

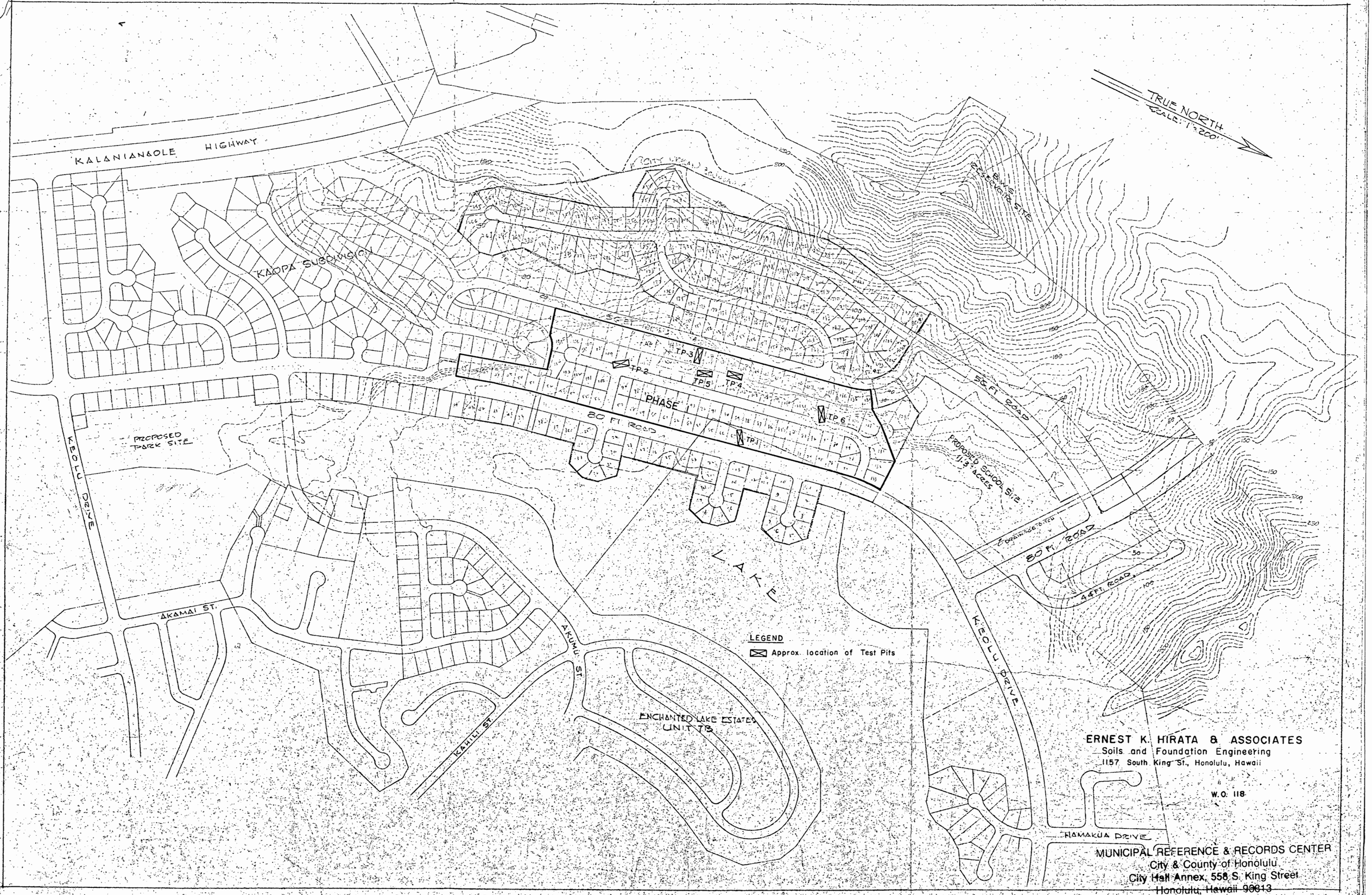
Boring or Test Pit No.	TP 2	TP 3	TP 3	TP 4	TP 5
Depth (ft.)	3'	5'	10'-11'	5'	0'-3'
Atterburg Limit Tests					
Liquid Limit			54.3		42.5
Plastic Limit			33.8		31.0
Plastic Index			20.5		11.5
Soil Classification	CL	OH	MH	MH	ML
Expansion @ 90 PSF					
Natural				1.5	
Remolded					3.79
Expansion @ 700 PSF					
Natural					
Remolded					1.0
Unconfine Stress (PSF)					
Proctor					
Max. Dry Unit Wt. (PCF)			89.0		91.5
Optimum Water (%)			26.0		26.0
Wet Density In-Place (PCF)	113.5	111.0		109.5	
Moisture In-Place (%)	36.2	45.2		39.9	
Dry Unit Wt. In-Place (PCF)	83.4	76.4		78.5	

Plate D1

LABORATORY TEST RESULTS

Project: KAOPA #3 - Phase I **W.O.** 118

Boring or Test Pit No.	TP 5				
Depth (ft.)	6.5'				
Atterburg Limit Tests					
Liquid Limit					
Plastic Limit					
Plastic Index					
Soil Classification	OH				
Expansion @ 90 PSF	0.9				
Natural					
Remolded					
Expansion @ PSF					
Natural					
Remolded					
Unconfine Stress (PSF)					
Proctor					
Max. Dry Unit Wt. (PCF)					
Optimum Water (%)					
Wet Density In-Place (PCF)	98.4				
Moisture In-Place (%)	61.2				
Dry Unit Wt. In-Place (PCF)	61.0				



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